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Your reference

Our reference
DRW/BF/P02/079

Date
3rd April 2003

Dear Sirs,

Re: European Patent Application No. 00968193.3-2304
KBA (ADVANCED IMAGING TECHNOLOGY) (ISRAEL) LIMITED

In response to the examination report dated 4th November 2002, we file herewith replacement pages 2 to 4a of the description and replacement claims for this application, which we request be substituted for those pages of the description and the claims at present on file.

New pages 2 to 4a include acknowledgement of the prior art documents cited by the Examiner and consequential amendments to the statement of invention.

New independent claims 1 and 5 have been cast in two-part form and reference numerals have been inserted throughout the claims.

New independent claim 1 is based on claim 1 as filed including the subject matter of claim 2. Further amendments have been made for the sake of clarity. It is submitted that the independent claims now set out all of the essential features of an invention that is novel and inventive over the prior art.

With regard to the prior art, D1 discloses a system in which the modification treatment of the image data occurs upstream of the raster image processor. In contrast the present invention receives the image data and determines distortion parameters to be applied to the imaging device so as to produce a distorted image on the printing element thereby ensuring correct registration.

Cont'd ....

With regard to D2, this document discloses a register adjustment technique for a particular printing machine, that is a web press. In D2 the factors affecting register adjustment such as tension, humidity, etc. are supplied to the CPU. For each printing action the influencing factors are measured and supplied to the CPU to change the parameters of the imaging device so that the subsequent image can be correctly printed. D2 does not disclose a combination of image dependent errors and image independent errors in order to determine the combined registration error for producing the distortion parameters of the present invention.

With regard to the Examiner's inventive step objection, the Examiner argues that it is known for the skilled man to vary resolution of the image and to change timing signals for this purpose. However in the case of at least D1, the registration correction is performed on the incoming image data before transforming into machine dependent data format so that modification downstream of the raster image processor would not be contemplated by the skilled man.

The amendments made to the description and claims also deal with the points 1 to 3 and item VII of the preliminary examination report and points 1 to 5 of item VIII of the preliminary examination report.

Every attempt has been made to comply with the convention and rules. Should the Examiner have any further objections that might be dealt with in a telephone conversation he is invited to telephone the undersigned. As a precautionary measure only Oral Proceedings are requested.

Form 1037 is attached.

Yours faithfully,
EDWARD EVANS BARKER

Duncan White

include plate cylinders having lost their roundness from wear or the like, and loosening of gears, bearings, etc., typically from wear over time.

Paper errors typically result from paper wetting by fountain solution and ink, and by forces applied on the paper by the printing press, that tend to deform the paper. With the paper deformed, data is printed at undesired or unintended locations. Even when the deformation forces on the paper are released, the paper does not usually recover to its original configuration, and thus, there is a difference between the data (on the imaged printing plate) and the resultant printed image.

Paper deformation effects, that result in paper errors, are explained by Figs. 1A-1C. Specifically, Fig. 1A shows the desired or ideal situation where a rectangular image 20, formed of lines 20a and 20b, is to be imposed on the substrate 22, typically paper. In Fig. 1B, the paper 22 has been impressed with a first separation, here a black (K of the CMYK) impression 24. This impression 24 is trapezoidal in shape (formed of lines 24a, 24b) as a result of the paper deformation in the press. Subsequently, in Fig. 1C, a second separation, for example a Cyan or "C" separation is impressed onto this deformed paper 22, as represented by broken line 26, in a mis-registration. Similarly in this manner, the subsequent Yellow "Y" and Magenta"M" separations will also be mis-registered in accordance with the paper deformation.

In conventional press systems, some of the mis-registration caused by the fixed errors was correctable mechanically by the operator after reviewing the initial printed sheets. In this case, the operator manually adjusted the relative positions of the printing plates or changed pressure on the printed substrate.

These manual, operator-made adjustments have drawbacks. Initially, these adjustments are time consuming and require considerable operator skill.

Additionally, the adjustments of plate cylinders required expensive mechanical devices. Even in conventional presses, although the time required for adjustment is lessened, the adjustment machinery is more complex and more expensive.

A few presses have been designed such that printing plates are imaged on the press, or "on-press", whereby the plates are not removed from the press

for imaging. One exemplary press is the Model 74 KARAT offset digital press, manufactured by a Karat Digital Press of Herzlia, Israel in a joint venture with KBA (Koenig & Bauer Aktiengesellschaft). This design, besides reducing the make ready or preparation time, allows elimination of most of the registration fixed errors.

US-A-5365847 discloses a control system for a printing press including a device for determining a reference printing image for the outer surface of a printing cylinder, and a device for modifying the reference printing image. A device for forming the modified printing image including means for determining a misregistration of said cylinder relative to another cylinder and means responsive to misregistration determining means for modifying the reference printing image to the subsequent printing image.

EP-A-0770480 discloses a digital printing press system including a plurality of imaging units, a raster image processor, an error detection device, and an image data modification circuit. The image modification circuit is connected upstream of the raster image processor and communicates with the error detection device to modify the image data on the basis of register error signals from the area detection device.

The present invention provides a system for elimination of printing registration errors as set out in claim 1. The present invention also provides a method of eliminating printing registration errors as set out in claim 5 below.

The present invention improves the process of on-press printing member, typically printing plate, imaging, as it provides an automatic process for plate preparation that compensates for registration and print-length errors (plate loading is performed before imaging and therefore the position accuracy is determined by the imaging system). The system of the present invention creates deformed images on the printing members, typically plates, during the imaging stage, these deformed images, being such that the separations will be in register (coordinated) after printing.

The present invention automatically determines the exact position for each data pixel within the distorted image to be placed onto the plates. This position is a sum of fixed errors and errors associated with stretch of the substrate, typically paper.

The invention also provides an automatic procedure for predicting paper stretch errors.

The correction process uses the image as a measure of the distribution of the ink load and a set of fixed parameters (determined by the paper, ink and other press conditions) to solve a differential equation that calculates the errors associated with the paper stretch. These errors are added to the fixed-errors map to obtain the final errors. The final pixel-location map is deduced by inverting the process, namely finding the position of a pixel such as when the position error is added to the position set, the requested position on print will be obtained. The resulting map is implemented, in conjunction with a"strobe" timing card and/or data manipulation card, to create the distorted plate image, resulting in a printing plate being imaged such that misregistration of the separations forming the printed image on the substrate are minimized or eliminated altogether.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described with reference to the accompanying drawings, wherein like reference numerals or characters identify corresponding or like components. In the drawings:

Figs. 1A-1C are diagrams useful in explaining problems associated with the prior art ;

Fig. 2 is a schematic diagram of the imaging head and the strobe card and associated systems in accordance with an embodiment of the present invention;

Fig. 3 is a flow chart detailing an embodiment of the present invention ;

Fig. 4 is a diagram of a printed pattern where the ink load is uniform along the Y-axis;

Fig. 5 is a plot of the registration error along the X-axis, in accordance with the printed pattern of Fig. 4 ;

Fig. 6 is a diagram of a printed pattern where the ink load is uniform along the X-axis; and

Fig. 7 is a plot of the registration error along the Y-axis, in accordance with the printed pattern of Fig. 6.

DETAILED DESCRIPTION OF THE DRAWINGS

The present invention is operable with printing presses, typically digital offset printing presses. For example, one such digital printing press, that uses printing plates is commercially available as the Quickmaster DI, from Heidelberg Druckmaschinen AG of Germany. The present invention utilizes digital offset printing deformation that is performed during the stage of imaging the printing plates and/or cylinders.

The present invention utilizes a microprocessor or other computing device, as detailed above, to automatically obtain relevant information as to the amount of paper distortion induced by the ink-load distribution in the image to be

CLAIMS

1. A system for elimination of printing registration errors, comprising a processor for computing distortion parameters and an imaging system in communication with said processor and configured for exposing a distorted images, characterised in that the processor is programmed for:

receiving input data including paper data, at least one machine parameter (106) and ink distribution data (102), the processor calculating image dependent errors from said input data;

receiving at least one fixed error map (108) dependent on machine parameters and obtained during a calibration run; and

predicting registration errors based on the fixed error map (108) and said image dependent errors; and

computing distortion parameters based on said registration errors for creating distorted images.

2. A system as claimed in claim 1, wherein said ink distribution data for an image file to be exposed is provided by a low resolution image file (102) derived from said image file.

3. A system as claimed in claim 1 or 2, where said imaging system includes a strobe card (72) configured for changing timing signals.

4. A system as claimed in claim 1 or 2, wherein said imaging system includes means for changing the resolution of an image.

5. A method of eliminating printing registration errors in a system comprising a processor for computing distortion parameters and an imaging system in communication with said processor and configured for exposing a distorted images, characterised by:

receiving input data including paper data, at least one machine parameter (106) and ink distribution data (102),

calculating image dependent errors from said input data;

receiving at least one fixed error map (108) dependent on machine parameters and obtained during a calibration run; and

predicting registration errors based on the fixed error map (108) and said image dependent errors; and

computing distortion parameters based on said registration errors for creating distorted images.

6. A method as claimed in claim 5, wherein said step of computing includes providing a reference image (102), calculating errors for substantially all of the pixels for at least one colour separation in said reference image; and

utilizing at least one of strobe data or data manipulation card (72) in combination with said calculated errors to control the rate of imaging to create a distorted image.

7. A method as claimed in claim 6, wherein said step of providing a reference image includes providing said reference image in a low resolution file (102).

8. A method as claimed in claim 5, 6 or 7, additionally comprising providing a printing member; and placing said distorted image onto said printing member.